Pocket guide to determine soil risk for farm dairy effluent application
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Soils across New Zealand have been classified into high and low soil risk categories for farm dairy effluent application.

Management practices need to be matched to soil and landscape risk in order to prevent loss of effluent into the surrounding environment.

This field guide will take you step by step through the process of working out the soil risk for a farm.
Soil risk categories overview

C  Yes  Sloping land (> 7 degrees).

B  Yes  Impeded drainage (including imperfectly drained) or low infiltration rate\(^2\).

A  Yes  Artificial (mole and pipe) drainage or coarse soil\(^1\) structure in topsoil.

E  Yes  Well drained but very light flat land (< 7 degrees). With a very stony sandy layer within 300 mm depth.

D  Yes  Well drained flat land (< 7 degrees).

The soil risk decision tree shows the 5 risk categories with those in red **High Risk (A,B,C)** and those in green **Low Risk (D,E)**.

\(^1\) Soils with 80% or more soil aggregates captured on a 10 mm sieve within the top 300 mm soil layer are considered to have coarse soil structure.

\(^2\) Low soil infiltration rate is defined as 10 mm/hr or less.
Soil risk categories overview

Step 1. Check out soil information for the specific area on-line

Step 2. Understand the A,B,C,D,E risk profiles and what they mean

Step 3. Review the topography of the farm

Step 4. Verify soil risk on-farm by digging some test pits

Step 5. If unsure consult a soils expert
Step 1. Soil information on-line

Go to S-map on-line website http://smap.landcareresearch.co.nz/home
Choose the maps and factsheets button (be patient, it can take a minute or two to load)
Read and accept the disclaimers to enter the site
Step 1. Soil information on-line continued

Find the property by entering the address in the location search box, and then select the envelope to search for the address.

Alternatively, use the navigate and zoom buttons to find the area of interest. The map will automatically zoom to your location, and highlight as a red dot.
Turn on the soil map by selecting **S-map Polygons and Labels**
To identify the soil type(s) select the **Feature information** button, and click on the map where you want info.

A **popup box** will appear listing the soil type(s) present. Click on the soil name to open a factsheet about the soil.

On page two of the fact sheet the dairy effluent risk category is shown.
Not all dairy farming areas in New Zealand have their soil risk classification known, if this affects your farm then give the local regional council a call or visit their website. They may have soil information to assist you.
### Step 2. Understand the A,B,C,D,E risk profiles

This table describes effluent considerations related to the risk class.

<table>
<thead>
<tr>
<th>Category</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil and landscape feature</td>
<td>Artificial drainage or coarse soil structure</td>
<td>Impeded drainage or low infiltration rate</td>
<td>Sloping land (&gt;7°) or land with hump &amp; hollow drainage</td>
<td>Well drained flat land (&lt;7°)</td>
<td>Other well drained but very light flat land (&lt;7°)</td>
</tr>
<tr>
<td>Risk</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Application depth (mm)</td>
<td>&lt; SWD&lt;sup&gt;1&lt;/sup&gt;</td>
<td>&lt; SWD</td>
<td>&lt; SWD</td>
<td>&lt; 50% of PAW&lt;sup&gt;2&lt;/sup&gt;</td>
<td>≤ 10 mm &amp; &lt; 50% of PAW&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Storage requirement</td>
<td>Apply only when SWD exists</td>
<td>Apply only when SWD exists</td>
<td>Apply only when SWD exists</td>
<td>24 hours drainage post saturation</td>
<td>24 hours drainage post saturation</td>
</tr>
<tr>
<td>Max depth: High rate tool</td>
<td>10 mm</td>
<td>10 mm</td>
<td>10 mm&lt;sup&gt;3&lt;/sup&gt;</td>
<td>25 mm&lt;sup&gt;4&lt;/sup&gt; (10 mm at field capacity)</td>
<td>10 mm</td>
</tr>
<tr>
<td>Max depth: Low rate tool</td>
<td>25 mm</td>
<td>25 mm</td>
<td>10 mm</td>
<td>25 mm</td>
<td>10 mm</td>
</tr>
</tbody>
</table>
1 SWD is the soil water deficit
2 PAW is the plant available water in the top 300 mm of soil
3 Only applicable when instantaneous application rate from the irrigator is less than the infiltration rate
4 Suggested maximum application depth when a suitable SWD exists (≥ 15 mm)

For all the risk categories the application rate should always be less than the soil infiltration rate otherwise you will get ponding (on sloping land the instantaneous application rate needs to be less than the soil infiltration rate or you will get run-off).
Step 3. Review the topography of the farm

Sloping land greater than 7°?
If, yes → Category C High Risk
If, no → Go to Step 4

Clinometers (inclinometers) are tools for measuring slope angle. They can be sourced from suppliers of technical instruments.

Alternatively these photos of a car on a slope gives some idea of slope, 7 °is not actually that steep!
Slope less than 7 degrees (actual slope of 6 degrees)

Slope greater than 7 degrees (actual slope of 14 degrees)

Slope less than 7 degrees (actual slope of 6 degrees)

Slope greater than 7 degrees (actual slope of 14 degrees)
Those with smartphones can download apps for this. For example: iphoneappsplus.com/utilities/clinometer---max--precision-level-and-slope-finder/index.htm

Best to lay the phone along a length of wood to average out the land slope.
All hump and hollow drained land is Category C High Risk
Step 4. Verify soil risk category by digging a test pit

First check to ensure no underground services are near proposed pit site.

Dig a small soil pit about 300 x 300 mm square x 400 mm deep with a spade.

- Keep the sides of the pit vertical and observe the depth to gravels (if present)
- Clean up one side of the pit so it is smooth (ideally either facing the sun or completely in the shade – so it is uniformly light for photographing)
- Identify any boundaries of soil layers, usually identified by a change in soil colour (in the photo above the subsoil layer is apparent in the base of the pit in contrast to the brown colour of the topsoil above)
How many test pits are needed?

- Sloping land greater than 7 degrees is automatically Class C High risk, so there is no need to locate pits here
- Recommend that an average of one test pit per 6 hectares are dug (this is a mapping scale of 1:25,000)
- Avoid fencelines, gateways, trees and around troughs
- Digging multiple test pits will indicate any major soil variations between paddocks and locate areas of low risk soils on the farm
- Take a picture of the soil profile of each pit and record on farm map the rough location of each pit.
Step 4. Verify soil risk category by digging a test pit continued

Is the soil predominately peat?

If, yes ➞ Category B **High Risk**
If, no ➞ Keep working through this step

Peat soil like those in the photos above is characterised by a high level of organic matter that has accumulated in areas with a high water table. They can be recognised by black to very dark brown colours and when rubbed between the fingers, peat material often has a greasy feel. Plant material decomposes slowly in peat and is often observable in the soil pit.
Does the soil have impeded drainage?

Identifying impeded drainage, (imperfectly and poorly drained soils), is done primarily by soil colour and the presence, size and colour of soil mottles within 400 mm depth. Soil mottles are the ‘spots’ or ‘blotches’ of colour different from the predominant soil matrix colour (excluding pieces of topsoil), often specks of rusty orange or grey or bluish grey colours.

Can you see spots or blotches of colour in the side of the test pit?

If, yes  ➔  Category B High Risk
If, no  ➔  Keep working through this step
Does it have low infiltration rate?

If, yes  ➔  Category B High Risk

If, no  ➔  Keep working through this step
Does it have artificial (mole and pipe) drains?

If, yes ➔ Category **A High Risk**

If, no ➔ Keep working through this step

Mole drains are very effective at draining wet areas of a farm. (Unfortunately they can also be a good way for effluent to enter waterways through the drainage network.)

If possible mole drain areas should be avoided for effluent application. If you cannot avoid them then Category **A High Risk**.
Step 4. Verify soil risk category by digging a test pit continued

How to work out if soil has coarse soil structure in topsoil?

To check this category out, dig out a 200 mm x 200 mm x 300 mm deep sod from the wall of the pit. Tear it in half or cut with a spade.

Fine soil structure, not Category A

Medium soil structure, not Category A

Coarse soil structure, firm clods with few aggregate soil risk Category A High Risk
Does it have coarse soil structure?

If, yes → Category A High Risk
If, no → Go to final check

Final check

• If sloping land greater than 7 degrees then High Risk
• Artificial (mole and pipe) drainage then High Risk
• Hump and hollow land then High Risk
• Impeded drainage then High Risk
• Peat present then High Risk
• Low infiltration rate then High Risk
• Coarse soil structure then High Risk

If the soil does not show any of these characteristics then likely to be Low Risk
Step 4. Verify soil risk category by digging a test pit continued

Examples of Category D Low Risk soils
Category **D Low Risk** from Southland, Canterbury, and Taranaki. These soils are well or moderately well drained soils, on slopes < 7 degrees, with very stony sand at depths greater than 300 mm.
Examples of Category E Low Risk soils

An example of a soil classified as Category **E Low Risk** with very stony sand within 300 mm depth.
Step 5. Consult a soils expert

If still unsure you might find it beneficial to contact a soils expert. This may be particularly important if the farm is located in a catchment of focused attention or soil risk is specified in your consent.

A list of available experts can be found on the New Zealand Society of Soil Science
http://nzsss.science.org.nz

Or contact:

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Your local regional council may also be worth contacting